UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/717,207	11/19/2003	J. Thomas Fowler	TI01.702US	6009

51886 7590 04/12/2007

FINCH & NGUYEN PLLC
P.O. BOX 1358
CONCORD, NH 03302

EXAMINER	
PIGGUSH, AARON C	
ART UNIT	PAPER NUMBER
2838	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/717,207	FOWLER ET AL.	
	Examiner	Art Unit	
	Aaron Piggush	2838	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 December 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *23-26* is/are allowed.

6)☐ Claim(s) *1-7,12,13,18-22 and 31-41* is/are rejected.

7)☒ Claim(s) *8-11,14-17 and 27-30* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/22/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 12-17, 27-30, and 36 are objected to because of the following informalities: Claims 12, 13, 27, and 36 recite the limitation "second switch"; however, there is insufficient antecedent basis for this limitation in the claims because there is no mention of a first switch. It is therefore indefinite as to whether or not there is supposed to be two switches in the claims. The other claims (14-17 and 28-30) are objected to as being dependent upon an objected claim. Appropriate correction is required.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-7, 12, 13, 20, 22, 31-36, 39, and 41are rejected under 35 U.S.C. 102(b) as being anticipated by Eaves (US 5,656,915).

With respect to claim 1, Eaves discloses a system, comprising:

a string of electrical energy storage units (no. 4a-4d in Fig. 1); and

a power converter selectively coupled to an individual storage unit of the string of storage units (col 16 ln 5-17), the power converter being configured to transfer energy bidirectionally between the individual storage unit and the string of storage units (col 16 ln 7-11 and ln 53-56), and to balance state of charge of the individual storage unit to a target state of charge, the state of charge of the individual storage unit being a fraction of a fully charged

capacity of the individual storage unit (abstract, col 18 ln 21 to col 19 ln 26, and Fig. 11). Please also see the response to the applicant's arguments presented near the end of this office action. Additionally, it should be noted that a target state of charge could be a full charge or an equal state of charge and a fraction of a fully charged capacity could be a full charge also (i.e. 1/1 is a fraction but is still equal to 1).

With respect to claim 2, Eaves discloses the system of claim 1, wherein the power converter is configured to transfer energy at a controllable rate of transfer (col 18 ln 35-42 and col 17 ln 25-31).

With respect to claim 3, Eaves discloses the system of claim 1, wherein the power converter is configured to monitor voltage and current data of the individual storage unit resulting from a transfer of energy (col 16 ln 37-52).

With respect to claim 4, Eaves discloses the system of claim 1, wherein the power converter is configured to transfer units of energy between the individual storage unit and the string of storage units (col 16 ln 53-56 and ln 10-13).

With respect to claim 5, Eaves discloses the system of claim 1, wherein the power converter comprises:

a primary inductor (no. 7p in Fig. 1);

a first secondary inductor magnetically coupled to the primary inductor (no. 7s in Fig. 1);

a first switch selectively coupling the individual storage unit to the primary inductor (no. 16e in Fig. 2a); and

the first secondary inductor coupling to an output capacitor (no. 8c in Fig. 1);

the output capacitor coupled in parallel to the string of storage units (no. 8c and 4a-4d in Fig. 1).

Additionally, when the first switch mentioned above selectively couples the individual storage unit to the primary inductor, the circuit will have another switch closed so that there will be a complete connection across the battery cell selected, as can be seen in Fig. 2a.

With respect to claim 6, Eaves discloses the system of claim 5, further wherein:

the power converter is further configured to transfer energy form the individual storage unit to charge the primary inductor when the first switch is on (col 13 ln 20-22); and

to discharge energy into the first secondary inductor to charge the output capacitor when the first switch is off, the output capacitor discharging energy to the string of storage units (col 13 ln 22-27).

With respect to claim 7, Eaves discloses the system of claim 5, further comprising:

a first pulse generator (no. 1 in Fig. 1) configured to provide first enable signals to the first switch (no. 2 in Fig. 1, no. 27, 26a, 26c, and 26d in Fig. 3, and col 16 ln 21-37);

the first switch being configured to couple the individual storage unit to the primary inductor (no. 16e in Fig. 2a is coupled to no. 7p in Fig. 1) in response to the first enable signals, and to transfer energy from the individual storage unit to the string of storage units (col 16 ln 7-11 and ln 53-56 and col 13 ln 22-27).

Furthermore, the microcontroller acts as a pulse generator because it generates a pulse signal to the MUX and the driver, which in turn force the MOSFET switches of the device to turn on or off and connect the storage unit or units to the inductor.

With respect to claim 12, Eaves discloses the system of claim 1, further comprising:

a primary inductor (no. 7p in Fig. 1);

a first secondary inductor magnetically coupled to the primary inductor (no. 7s in Fig. 1);

a second switch selectively coupling the first secondary inductor to the string of storage units (no. 16c in Fig. 2a), and configured to transfer energy from the string of storage units to charge the first secondary inductor when the second switch is on (col 13 ln 20-22), and to discharge energy into the primary inductor and charging the individual storage unit when the second switch is off (col 13 ln 22-27).

Additionally, when the second switch mentioned above selectively couples the first secondary inductor to the string of storage units, the circuit will have another switch closed so that there will be a complete connection across the battery cells selected, as can be seen in Fig. 2a.

With respect to claim 13, Eaves discloses the system of claim 12, further comprising:

a first pulse generator (no. 1 in Fig. 1) configured to provide first enable signals to the second switch (no. 2 in Fig. 1, no. 27, 26a, 26c, and 26d in Fig. 3, and col 16 ln 21-37);

the second switch being configured to couple the string of storage units to the first secondary inductor (no. 16c in Fig. 2a is coupled to no. 7s in Fig. 1) in response to the

first enable signals, and to transfer energy from the sting of storage units to the individual storage unit (col 16 ln 7-11 and ln 53-56 and col 13 ln 22-27).

Furthermore, the microcontroller acts as a pulse generator because it generates a pulse signal to the MUX and the driver, which in turn force the MOSFET switches of the device to turn on or off and connect the storage unit or units to the inductor.

With respect to claim 20, Eaves discloses the system of claim 1, wherein each storage unit is a storage cell (col 4 ln 25-26 and no. 4a-4d in Fig. 1).

With respect to claim 22, Eaves discloses the system of claim 1, wherein a battery pack comprises a string of one or more storage units (col 4 ln 25-26 and no. 4a-4d in Fig. 1).

With respect to claims 31-36, see the rejection of claims 1-5 and 12 above, respectively. Please also note the response to arguments presented by the applicant near the end of this office action.

With respect to claim 39, see the rejection of claim 20 above.

With respect to claim 41, see the rejection of claim 22 above.

3. Claims 1, 18, 19, 21, 31, 37, 38, and 40 are rejected under 35 U.S.C. 102(b) as being anticipated by Anzawa (US 2002/0109482).

With respect to claim 1, Anzawa discloses a system, comprising:

a string of electrical energy storage units (no. 1-1, 1-2, and 1-n in Fig. 1); and

a power converter selectively coupled to an individual storage unit of the string of storage units(pg 2 para 0016 and 0017), the power converter being configured to transfer energy bidirectionally between the individual storage unit and the string of storage units (pg 2 para 0018 to 0023), and to balance state of charge of the individual storage unit to a

target state of charge, the state of charge of the individual storage unit being a fraction of a fully charged capacity of the individual storage unit (abstract, para 003, and para 0013). Please also see the response to the applicant's arguments presented near the end of this office action. Additionally, it should be noted that a target state of charge could be a full charge or an equal state of charge and a fraction of a fully charged capacity could be a full charge also (i.e. 1/1 is a fraction but is still equal to 1).

With respect to claim 18, Anzawa discloses the system of claim 1, wherein the power converter comprises:

an up-converter configured to transfer energy from the individual storage unit to the string of storage units (T and inductors near S2 and S1 in Fig. 11); and

a down-converter configured to transfer energy from the string of storage units to the individual storage unit (T and inductors near S1 and S2 in Fig. 11).

Additionally, the transformer of Fig. 11 acts as an up-converter or a down-converter because of the turn ratio difference. When the charge from an individual storage unit is transferred to the capacitor (through the inductor near an individual storage unit to the inductor near S1), the charge will be greater because it is moving from an inductor with less turns to one with greater turns. That charge is then used for the equalization of the other storage units. Furthermore, when the charge from a string of storage units is transferred from the capacitor (through the inductor near S1 to the inductor near an individual storage unit), the charge will be smaller because it is moving from an inductor with more turns to one with less turns. That charge is used for the equalization of the individual storage unit (pg 10 para 184).

With respect to claim 19, Anzawa discloses the system of claim 18, wherein a common transformer is configured to serve as the up-converter (T and inductors near S2 and S1 in Fig. 11) and the down converter (T and inductors near S1 and S2 in Fig. 11).

Further explanation for the rejection of claim 19 is addressed above in the rejection of claim 18.

With respect to claim 21, Anzawa discloses the system of claim 1, wherein each storage unit is a battery module having a string of storage units (three battery modules containing three storage units within each in Fig. 3 and pg 7 para 0129).

With respect to claims 31, 37, and 38, see the rejection of claims 1, 18, and 19 above, respectively. Please also note the response to arguments presented by the applicant near the end of this office action.

With respect to claim 40, see the rejection of claim 21 above.

Allowable Subject Matter

4. Claims 23-26 are allowed.

Claim 23 recites a system comprising a string of electrical energy storage units, a power converter configured to transfer energy bidirectionally between the individual storage unit and a string of storage units, and first and second pulse generators, the second pulse generator providing second enable signals to the first pulse generator, wherein the second enable signals control the transfer of energy from the individual storage unit to the string of storage units at a controllable rate.

The art of record does not disclose the above limitations, nor would it be obvious to modify the art in such a manner.

5. Claims 8-11 and 14-17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Furthermore, claims 14-17 are also objected to as being dependent upon an objected claim, as noted in the office action above, which would also need to be addressed for those claims (14-17) to be found allowable.

Claims 8 and 14 recite a second pulse generator providing second enable signals to the first pulse generator, wherein the second enable signals control the transfer of energy at a controllable rate by controlling the first pulse generator.

The art of record does not disclose the above limitations, nor would it be obvious to modify the art in such a manner.

6. Claims 27-30 would be allowable if rewritten or amended to overcome the objections due to lack of antecedent basis, as mentioned in the office action above.

Claim 27 recites a system comprising a string of electrical energy storage units, a power converter configured to transfer energy bidirectionally between the individual storage unit and a string of storage units, and first and second pulse generators, the second pulse generator providing second enable signals to the first pulse generator, wherein the second enable signals control the transfer of energy from the individual storage unit to the string of storage units at a controllable rate.

The art of record does not disclose the above limitations, nor would it be obvious to modify the art in such a manner.

Response to Arguments

7. Applicant's arguments filed December 22, 2006 have been fully considered but they are not persuasive.

With respect to claims 1-22, applicant argues that neither Eaves nor Anzawa discloses or suggests anything that balances state of charge as recited in the amended claims, let alone a power converter selectively coupled to an individual storage unit of a string of storage units and configured to balance state of charge. Applicant further states that balancing state of charge is different from balancing cell voltage.

Examiner respectfully disagrees for the following reasons: As mentioned in the previous office action, Eaves does disclose indications of SOC, as noted in col 7 ln 54-65, and clearly shows balancing state of charge in claims 7 and 10. Furthermore, state of charge is directly related to the voltage level of a cell (especially when compared to its maximum possible voltage level). The examiner notes the applicant's description of the differences between capacity in ampere-hour and state of charge in percentage; however, the references used mainly refer to voltage levels (although Eaves clearly recites SOC in claims 7 and 10, along with col 7 ln 54-65). It is still believed to be well known to one of ordinary skill in the art that the voltage level can be used as a indication of the state of charge of a cell/battery, especially when the cells/batteries are new or under the same environmental conditions (i.e. temperature) or have degraded at substantially the same rate. A SOC determination only using voltage level may be less accurate than using ampere-hours or when battery internal resistance and temperature are taken into account, but it can still reasonably be considered an SOC of the battery nonetheless.

With respect to claims 31-41 (which are new) , applicant argues that Eaves and Anzawa do not disclose or suggest a system including a sting of electrical energy storage units and a power converter coupled to a selected portion of the string of electrical energy storage units and to end points of the string of electrical energy storage units.

Examiner respectfully disagrees for the following reasons: Please note the rejections above. Additionally, "end points" can be considered to be any points on the strings (i.e. any of the nodes between the cells or at the bottom/top of the string). Furthermore, any of the connection points between the cells/strings/batteries seem to be able to be coupled in some manner (i.e. couple is defined as linking or connecting) at different points in time. Lastly, there is no definition found or any mention of the term "end point" in the applicant's specification, and therefore, it is interpreted in the broadest reasonable sense.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aaron Piggush whose telephone number is 571-272-5978. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Karl Easthom can be reached on 571-272-1989. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AP

KARL EASTHOM
SUPERVISORY PATENT EXAMINER